

REMARKS

A reconsideration of this patent application is respectfully requested in view of the foregoing amendments, and the following remarks.

In the Final Office Action, the following objections and rejections were set forth:

- (1) Claims 18, 19, 25, 27, 28, 31 were rejected due to indefiniteness.
- (2) In Claim 18: It was not clear what are reaction products, reactants, catalysts.
- (3) In Claim 19: The term "basically reacting" was indefinite.
- (4) In Claims 25, 27, 28: in addition, it is unclear what "ranges of ingredients" are.
- (5) In Claim 31: "nitre starch" is not understood.
- (6) Claims 18 to 34 were rejected since they are not patentable over *Ritter* in view of *Maruhashi*.

Each of claims 18, 19, 20, 25, 26, 27, 28, 29 and 30 have been amended so as to overcome the various formal rejections

under 35 U.S.C. 112. Thus in claim 18 the starch and the polymer are part of a polymer mixture; and the catalyst is glycerol. In claim 19, the process "comprises" various steps and not "consists of". Also "alkaline reacting" has replaced "basically reacting" in claim 19 and claim 26.

In claim 25, the range of added catalyst has been clarified. In claim 27 the weight ratio has been corrected to read "80:20".

With regard to the term "Nitre starch", this phrase could not be found in the disclosure. In claim 31, too, there is the term "native starch". It concerns only such a starch which retained its chemical and morphological structure grown in the plant and is only separated from the plant raw material by physical processes. Here the term "native starch" indicates chemically unchanged, non-thermoplasticized starch.

For all these reasons, all the claims are now in complete compliance with the requirements of 35 U.S.C. 112. Withdrawal of this ground of rejection is respectfully requested.

The Applicants comment upon the prior art rejection of the claims as follows:

The *Maruhashi Et Al U.S. Patent No. 5,106,890 [4]*, describes the manufacture of a foil made from a mixture of thermoplastic starch (TPS) and polyvinyl alcohol with a degree of hydrolysis of at least 93% (PVOH). (See *Maruhashi* at column 1 lines 65 to 69 and column 2 lines 1 to 12).

The production of thermoplastic mixtures made of TPS and PVOH with suitable plasticizers is known (see [1], [2], [3]). The two polymers are very similar to each other with respect to both their structures and properties. They are polyhydroxyl compounds with strong intermolecular H-bridges and they are therefore highly hydrophilic. These polymers are thermoplastic only in the presence of plasticizers, whereby the plasticizers or solvents for the two materials are identical, for example, such as water, glycerol, dimethyl sulfoxide, dimethyl acetamide, etc. According to the theorem of chemistry that "the like dissolves in like", it is possible to produce homogeneous mixtures from PVOH and TPS with suitable plasticizers. The pronounced homogeneity of the polymer mixture permits the manufacture of

thin sheets (minimum thickness 10 μm).

The solubility of this polymer mixture in water is reduced by cross-linking the polymer molecules via covalent bonds. This is in line with the current general level of knowledge in the field of polymer chemistry as well. The resistance to solvents or the stability of the polymers versus solvents increases with the degree of cross-linkage. In the special case, cross-linking impairs the biodegradability. It is conceivable that within a narrow range of the degree of cross-linking, the stability in water is adequate for some applications without losing the biodegradability. This highly restricting factor prevents other properties from being adapted, for example, such as adaptation of mechanical and rheological properties of the material to the profile of requirements of the application.

The purpose of the polymer mixture described in *Maruhashi [4]* is the manufacture of water-resistant, biodegradable foils or sheets from exactly such a polymer mixture.

As opposed to the prior art composition described by *Maruhashi Et Al*, the object of the present invention is to

provide a component that is characterized in that it has a homogeneous, polymeric structure that is comprised of partially hydrolyzed polyvinyl acetate (PVAc) with bonded silicates, and contains water and catalyst residues. The degree of hydrolysis may be in the range of 10% and 85% and is therefore distinctly different from the value specified by *Maruhashi*. The composition of the substance and consequently also the molecular structures of the component of the claimed invention are completely different from the material disclosed by *Maruhashi*.

The present invention as claimed is entirely different from the teachings of the cited prior art. The claimed component of the present invention is a functional polymer whose properties as a compatibilizer permits the manufacture of special polymer mixtures. The component cannot be employed in the sense of a material for producing molded articles, foils or sheets, coating material and the like.

The polymer mixtures produced with the use of the component [see 5] are basically different from the polymer mixtures described by *Maruhashi* as well.

The component of the present invention is used in mixtures of thermoplastic starch (TPS) with hydrophobic polymers such as polyesters. The hydrophobic polymers and the TPS are incompatible in mixtures because of their different hydrophilic properties. In accordance with the claimed invention for producing a practicable plastic based on starch, the smallest possible amount of a hydrophobic polymer is admixed to the TPS in order to secure the stability in water of the overall material. For processing the material thermoplastically, for example to produce molded articles, foils or sheets, finely particulate structures of the mixture are required. This is so that the material will phenomenologically behave as a uniform substance, which is also stable also when re-melted. This is another prerequisite. The component as defined by the invention is a compatibilizer that secures the formation of such a structure of the mixture and that stabilizes the mixture by subsequent reactions. Because of its functional properties, the claimed component initiates the development of that structure in the polymer mixture. However, there is no teaching of this supporting substance for the material in the prior art.

The cited patent WO 96/37544 (to Ritter et al) describes the

method for producing a mixture that can be processed thermoplastically and consists of

- polyvinyl acetate;
- polyvinyl acetate-co-vinyl alcohol; and
- inorganic water-insoluble filler, the latter being present in a finely distributed form.

According to the present invention, as claimed, the ingredients

- polyvinyl acetate;
- water glass;
- a limited amount of water; and
- a compound that will possibly supply Ca^{2+} ;

are intimately mixed at an elevated temperature and with strong shearing in an extruder, whereby the water-soluble silicates (water glass) are converted into water-insoluble silicates. The resulting material can be processed later in mixture with thermoplastic starch to produce molded articles with increased stability in water.

In the present application, the claimed invention is directed to a component that is comprised of

an organosilicate consisting of partially saponified polyvinyl acetate with bonded silicate structures; water; and glycerol.

A substantial difference over the prior art is in the type of silicate contained in the product. In the claimed component, it is an organosilicate; but with Ritter it is a filler. Mass-spectrometric identification of pyrolysis products of the claimed component demonstrate the existence of compounds with covalent bonding between inorganic silicate and residues of organic carbon compounds [6].

The reasons for the differences over the prior art are different starting materials and a basically different processing method. The following materials are used for producing the claimed component:

- Polyvinyl acetate dispersion;
- water glass solution;
- an alkaline reacting compound, e.g. alkali hydroxides, alkaline earth hydroxides, and glycerol.

As opposed to *Ritter*, the amount of water is basically not limited; in addition, the reaction mass contains glycerol for stabilizing the structure of the dispersion and for accelerating the heterogeneous reaction.

The reaction of the present invention is carried out in a reactor equipped with an agitator, using the batch procedure, i.e., the polyvinyl acetate dispersion with the glycerol is charged first and the water glass and the alkaline compound are gradually metered in at the reaction temperature. The water remains in the reaction mass throughout the entire process and is not extracted at least in proportionate amounts as described by *Ritter*. For reasons of facilitating the further processing for producing the starch mixture, excess water can be separated mechanically (by filtration, centrifugation) after the claimed component has been produced.

In a reactor equipped with an agitator, as it is employed also for producing the claimed component, the dwelling and reaction times are clearly longer, which is conditioned by the equipment, and the shearing forces applied are very much lower than in the continuous production process in an extruder as

described by *Ritter*.

Tests carried out with the component (VT40W, V340) dissolved in DMSO, a specimen (*Ritter* product) produced according to *Ritter Et Al.*, and a commercially available sample of a partially saponified PVAc (polyviol W45/450) with NMR, distinctly show the basic structural differences. The degree of saponification of the *Ritter* product is very low. The sequential lengths of the vinyl acetate and vinyl alcohol units are greater in the claimed component than in the commercial, comparative test specimen. This means that a vinyl acetate-vinyl alcohol copolymer with block-like sequences is produced under the claimed conditions as the claimed component, which is thus entirely different from the commercial, statistical copolymer.

Enclosed herewith is PTO Form 1449 along with copies of seven documents:

Literature

- [1] WO 91/02024, to BASTIOLI, C. ET AL.
- [2] WO 92/19680, TO BASTIOLI, C. ET AL.
- [3] Felix O. OTEY, William M. DOANE in "Starch: Chemistry and

Technology", ed. By R.L. Whistler, J.N. Bemiller, E.F. Paschall,
pages 399-400, Academic Press 1984

[4] US 5,106,890, to MARUHASHI, M. ET AL.

[5] DE 199 38 672, to BERGER, W. ET AL.

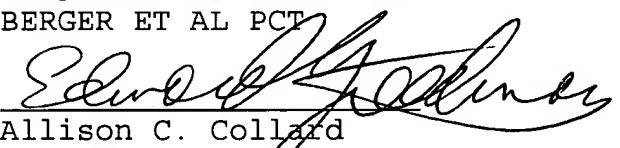
[6] Mass spectrum of the products of the pyrolysis of the
component

[7] Comparative NMR-test

In summary, claims 18 to 20 and 25 to 30 have been amended.

In view of these amendments, it is firmly believed that the
present invention, and all the claims, are patentable under
35 U.S.C. 103, over all the prior art applied by the Patent
Examiner. A prompt notification of allowability is respectfully
requested.

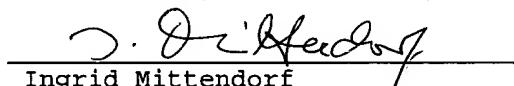
Respectfully submitted,
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Enclosures: (1) Marked-Up Version of Amended Claims;
(2) Copy Petition One Month Extension of Time;
(3) Submission of PTO Form 1449, and (7) references;
(4) Check in the amount of \$55.00.

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Assistant Commissioner of Patents, Washington, D.C. 20231, on October 5, 2001.


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MARKED-UP VERSION
OF
AMENDED CLAIMS

18. (Amended) A component [for producing polymer mixtures form thermoplasticized starch and a hydrophobic polymer,] comprising

organosilicates with homogeneous structure consisting of saponified polyvinyl acetate [and alkali silicate solution; reaction products prepared in situ; and residues of a catalyst employed during the producing.] with bound silicate structures, water and residues of the catalyst glycerol, which is suitable for producing polymer mixtures from thermoplasticized starch and a hydrophobic polymer.

19. (Amended) A process for producing a component consisting of saponified polyvinyl acetate [and alkali] with bound silicate[,] structures comprising

[intensive thorough mixing and shearing, for producing polymer mixtures from thermoplasticized starch and hydrophobic polymer polyvinyl acetate;]

hydrolyzing and saponifying the polyvinyl acetate/water dispersion in the presence of [a] the catalyst[,] glycerol with continuously adding of [basically] alkaline reacting compounds and of the alkali silicate to the intensively mixed and sheared mixture within a stirred batch reactor.

20. (Amended) The process according to claim 19, comprising presaponifying the polyvinyl acetate with [basically] alkaline reacting compounds up to a degree of hydrolysis of 10% to 40%; and

subsequently finally saponifying to a degree of hydrolysis of between [50% and 100%] 30% and 85%.

25. (Amended) The process according to claim 19, wherein the total amount of the catalyst compounds added is between [does not exceed an amount of] 0.5% and 20%[,] by weight based on the weight of the polyvinyl acetate.

26. (Amended) The process according to claim 25, comprising providing a batch process;

in the batch process, loading the polyvinyl acetate first in the form of an aqueous suspension, and heating to the reaction temperature of 100°C to 160°C;

metering the [basically] alkaline reacting compound in continuously for presaponification; and metering the alkaline water glass solution in at reaction temperature after the desired degree of saponification has been reached[,].

27. (Amended) The process according to claim 19,
wherein the mixing ratio of polyvinyl acetate to alkali
silicate expressed in weight proportions of the solid material is
in the range of 50:50 to [80:80] 80:20.

28. (Amended) The process according to claim 19, comprising
using sodium disilicate and a hydroxide [at least partially
instead of the alkali silicate solution] as a partial or full
substitute of the alkali silicate solution.

29. (Amended) The process according to claim 19, comprising
adding one or a plurality of [polyfunctional] organofunctional
silanes to the reaction batch or to the component.

30. (Amended) The process according to claim 29,
wherein the silane weight proportion amounts to 3% to 15% of
the amount of [silane introduced with] silicate in the alkali
silicate solution which is introduced in the reaction batch.